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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/459,305	12/10/1999	TOMOYUKI FURUHATA	0015.0010	9991

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EXAMINER

TRAN, THIEN F

ART UNIT PAPER NUMBER

2811

DATE MAILED: 03/27/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/459,305

Applicant(s)

FURUHATA, TOMOYUKI

Examiner

Thien Tran

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 13, 15-19, 30 and 32-39 is/are pending in the application.
- 4a) Of the above claim(s) 15 and 17-19 is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 13, 16, 30 and 32-39 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION***Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 02-19-2003 has been entered.

Claim Objections

Claim 30 is objected to because of the following informalities: line 5, "the tunnel insulating film" should be --the first tunnel insulating film--; and "the floating gate" should be --the first floating gate--; line 6, "the dielectric layer" should be --the first dielectric layer--; line 19, "the source/drain regions" should be --the first and second source/drain regions--. Appropriate correction is required.

Claim 33 is objected to because of the following informalities: line 4, "the substrate" should be --the semiconductor substrate--; line 4, "the tunnel" should be --the first tunnel--; line 5, "the floating gate" should be --the first floating gate--; line 6, "the dielectric layer" should be --the first dielectric layer--; line 6, "the substrate" should be --the semiconductor substrate--; line 8, "the substrate" should be --the semiconductor substrate--; line 11, "the substrate" should be --the semiconductor substrate--; line 18, "the substrate" should be --the semiconductor substrate--. Appropriate correction is required.

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Claim 34 is objected to because of the following informalities: line 2, after "from" delete "that of"; line 3, "source/drain areas" should be --sources--. Appropriate correction is required.

Claim 35 is objected to because of the following informalities: line 4, after "into" delete "in". Appropriate correction is required.

Claim 37 is objected to because of the following informalities: line 2, after "from" delete "that of"; line 3, "source/drain areas" should be --source/drain regions--. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 32, 33 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 32 is incomplete and defective since it depends on canceled claim 31.

Claim 33 recites the limitation "the floating gate" in line 19. Because of plural recitations of the limitation "floating gate" in the claim, it is unclear which floating gate is referred to, the first floating gate or the second floating gate. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 13, 16, 30, 33-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gill et al. (USPN 5,523,249) in view of Wang et al. (USPN 5,553,018).

Gill et al. discloses a semiconductor device (Figs. 2a, 2b, 3f) comprising a semiconductor substrate 22 including first and second memory cells areas; the first memory cell area including a first horizontal field effect transistor 10 comprising a first tunnel insulating film 13a in contact with the semiconductor substrate, a first floating gate 13 in contact with the first tunnel insulating film, a first dielectric layer 27 in contact with the first floating gate, a first control gate 14 in contact with the first dielectric layer, and first source/drain regions (11, 12) extending into the semiconductor substrate; the second memory cell area including a second horizontal field effect transistor 10 comprising a second tunnel insulating film 13a in contact with the semiconductor substrate, a second floating gate 13 in contact with the second tunnel insulating film, a second dielectric layer 27 in contact with the second floating gate, a second control gate 14 in contact with the second dielectric layer, and second source/drain regions (11, 12) extending into the semiconductor substrate; the first and second source/drain regions each including an upper surface that extends along a common plane; a groove located in the semiconductor substrate at a position between the first and second memory cell areas; and a connecting area 17 electrically connecting the first source region with the second source region, wherein the connecting area extends under the groove in the

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semiconductor substrate. Gill et al. further discloses the source/drain regions (11, 12) doped at a dosage of about $6 \times 10^{15} \text{ cm}^{-2}$. Gill et al. does not disclose the connecting area 17 having an electric resistance lower than any of the first and second source/drain regions. Wang et al. discloses a connecting area 500 connecting source regions together as a common source line. Wang et al. discloses the connecting area 500 is doped at a dosage of $1 \times 10^{16} \text{ cm}^{-2}$. It would have been obvious to a person having ordinary skill in the art at the time the invention was made to form the connecting area 17 of Gill et al. by implanting the area with dopants at a dosage of $1 \times 10^{16} \text{ cm}^{-2}$ as taught by Wang et al. in order to provide the connecting area 17 with low resistivity. As a result, the connecting area 17 has a higher impurity concentration than the impurity concentrations of the first and second source/drain regions (11, 12). High impurity concentration provides low electric resistance; therefore, the connecting area 17 has an electric resistance lower than any of the source/drain regions.

Regarding claims 34 and 37, the groove has a depth, and the connecting area 17 has an impurity depth that is offset from that of the adjacent sources 11 by the depth of the groove.

Regarding claim 38, Gill et al. further discloses an insulating material 23 in contact with the semiconductor substrate in the groove.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thien Tran whose telephone number is (703) 308-4108. The examiner can normally be reached on 8:30AM - 5:00PM Monday through Friday.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (703) 308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9318 for regular communications and (703) 872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

tt
March 21, 2003



Thien Tran
Patent Examiner
Technology Center 2800